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Device with a unit for activating an adjustable drive unit of a motor vehicle

The invention concerns a device with a unit for activating an adjustable drive unit of a motor vehicle according to the specifications of Claim 1.

From the US patent 2001 / 0056009 A1 a device with a unit is known which is equipped so that an especially continuously adjustable drive unit of a motor vehicle is activated independently of at least one control signal and at least in one phase to produce a virtual control signal and to use instead one real control signal for activating the drive unit. The activation is done as a function of a control signal which represents an adjustable angle of a gas pedal. The unit governs in the phase a propelling force of a motor vehicle containing the device so that a desired propelling force is adjusted, by which a constant separation to a vehicle traveling in front of the motor vehicle is maintained.

The invention is based on the task of providing a generic device which converts a constant travel desire of the driver in a comfortable way. The task is solved by the features of Claim 1. Advantageous arrangements are given in the subsidiary claims.

The invention proceeds from a device with a unit which is equipped so that an especially continuously adjustable drive unit of a motor vehicle is activated dependent upon at least one control signal and to produce at least in one

phase a virtual control signal and instead to use a real control signal for activating the drive unit.

It is suggested that the unit be equipped so that the drive unit is activated at least in a constant drive mode dependent upon the virtual control signal. Thereby it can advantageously be achieved that in the constant drive mode, no deviations from the actual control signal, i.e. produced by the driver of the motor vehicle, of a course of the control signal desired by the driver of the motor vehicle and anticipated by the unit do not lead to an adjustment process of the drive unit and indeed especially also then when the deviations have an infrequent proportion. No deviations of the control signal from the desired course can because of a constant drive desire of the driver are acknowledged as unwanted and are ignored, whereby the drover can have a peaceful driving feeling. Moreover by a suitable choice of a course of the virtual control signal advantages relative to a fuel consumption in the constant drive mode and a long service life of the drive unit can be achieved. This can be carried out mechanically precisely by an anticipation of a time course of the control signal determined by the constant drive desire of the driver by the virtual control signal as this is possible to a driver.

A time course of a control signal desired by the driver can be able to be anticipated reliably in the constant drive mode especially simply and advantageously. An especially simple control and/or regulating logic of the drive unit can be achieved when the constant drive mode differs from other operating modes only in the use of the virtual control signal instead of the real

control signal. An operating mode of the motor vehicle in which the unit sets up by a suitable choice of the control signal the essentially constant propelling power of the motor vehicle shall be designated as constant drive mode. Thereby it can come to an acceleration or to a slowdown of the motor vehicle dependent upon a driving resistance.

The drive unit can be constructed as a motor for example with adjustable throttle valves, as a drive, as a clutch, or as another adjustable unit appearing to the specialist as meaningful with an influence on the drive cord* of the motor vehicle. Due to the sensitivity of such units relative to small fluctuations in the control signal there are special advantages relative to comfort when the drive unit is constructed as a continuous operation of a motor vehicle. The real control signal can be given by any characteristic magnitude with an influence upon an activation of the drive cord appearing as meaningful to the specialist, adjustable by a driver. Due to the direct effect, however, the solution according to the invention is especially advantageously adjustable when the control signal represents an adjustment of a gas pedal or an adjustment angle of a gas pedal.

The unit can be made as a single part or a multiple part with the drive unit. By "provided" in this connection "laid out" and "equipped" should also be understood.

In this connection a control signal should be designated as "virtual" when it is

mechanically produced and at least extensively independent of an actual course of the real control signal produced by the driver. At least a characteristic magnitude, for example an rpm of the drive unit, should be uncoupled in the phase of the real control signal and be determined by the virtual control signal.

The virtual control signal can be produced by the unit itself or by a sub-unit, for example a computer unit.

An especially calm driving feeling in the constant driving mode can be achieved when the unit for determining a constant virtual control signal is provided. There are however also other time courses of the virtual control signal appearing as meaningful to the specialist which may be considered.

If the unit is equipped for determining the virtual control signal dependent upon a real control signal at the switch on point of the constant drive mode, advantageously an adaptation of the constant drive mode to the circumstance leading to the switching on of the constant drive mode can be achieved.

If the virtual control signal to the switching on point is equal to the real control signal, it can advantageously be achieved that the switch on point in time at least can hardly be perceptible by the driver. It can advantageously be avoided that the driver gets a feeling of independence of the motor vehicle.

If the unit for switching on and switching off the constant drive mode dependently provided with a time course of a real control signal, it can advantageously be achieved that the driver by means of the control signal can exercise a full control over the motor vehicle. Thereby it can be achieved that an acceleration or braking desire of the driver is acknowledged when the unit is equipped to switch off the constant drive mode when the real control signal exits for an interval. The interval can thereby especially advantageously be adaptable to a long or medium term driving behavior of the driver and be determined in its average point by an average point of the real control signal.

If the unit is equipped for switching off the constant driving mode when a change speed of the real control signal cuts out for an interval, an especially fast reaction of the unit to an acceleration or braking wish of the driver can advantageously be achieved.

Analogous criteria for switching off the constant driving mode can advantageously be formulated relative to a time course of a speed of the motor vehicle and/or a driving resistance.

If the unit for activating the motor vehicle engine is provided dependent upon a discontinuous control signal upon switching off the constant driving mode, it can advantageously be achieved that the driver is imparted an especially spontaneous driving feeling. Especially when the unit for activating a continuous drive is provided, it can be achieved P803290/WO/1

that the unit in recognizing an acceleration desire abruptly reduces a translation whereby a torque reserve of a motor is abruptly increased. This is perceived by the driver as spontaneous downshifting. There are also however arrangements of the invention to be considered in which the unit smoothes the discontinuity in a way for example dependent upon a driver's profile.

Further advantages are given by the following illustration description. The figures represent an implementation example of the invention. The figures, the claims, and the description contain several features in combination. The specialist will also consider these features individually and combine them into additional purposeful combinations.

They show:

Fig. 1. A motor vehicle with a continuously adjustable drive unit, a gas pedal and a unit for activating the drive unit dependent upon a control signal from the gas pedal.

Fig. 2. A flow chart of a program for activating the drive unit from Figure 1 in a constant driving mode and in a normal mode.

Fig. 3. A decision diagram of the program from Figure 2, and

Fig. 4. a time flow of a real control signal and a virtual control signal.

Figure 1 shows a motor vehicle 12 with a unit 10 which is equipped for activating an adjustable drive unit 11 formed as a continuously variable drive dependent upon a real control signal α and upon a virtual control signal α_{virt}. The unit 10 is equipped so as to recognize a constant drive desire of a driver and a constant drive mode supporting this desire dependent upon a time course of the real control signal α while a phase T is switched on and switched off (Fig. 4) and at the end of the phase T. The real control signal α represents an adjustment angle of a gas pedal 13, includes a sensor integrated into the gas pedal 13 and can read the unit 10 over a CAN interface from a CAN bus of the motor vehicle 12. Moreover the unit 10 is so designed as to acquire additional characteristic values of the motor vehicle 12, for example a velocity v, an acceleration, an engine rpm, and a throttle valve angle of a motor vehicle through the CAN interface. A computer unit 14 of the unit 10 is equipped to calculate a driving resistance from the acceleration, the throttle valve angle, and the velocity v and to issue this as a characteristic value for a highway rise m.

The unit 10 is designed so that the program for recognizing a constant driving desire represented in Figure 2 as a flow chart sets a control bit c_b to 1 and otherwise to 0. After an initialization 15 the unit 10 determines in an interval determination step 16 the width and centers of gravity of intervals I_α, I_v, $I_{\alpha'}$ in which the speed v and the control signal α and a change velocity α' of the control signal α must necessarily vary so that the unit 10 recognizes the

constant driving wish. The centers of gravity of the intervals I_α, I_v, $I_{\alpha'}$ are an equalizing means over a pre-adjusted time interval of the respective values α, α', v and the width of the intervals I_α, I_v, $I_{\alpha'}$ are determined by the variance of the respective values α, α', v. In a threshold value determination step 17 the threshold values are stored in a memory unit of the unit 10 and indeed a maximum value m_{max} and minimum speed v_{min} are read out.

In a decision block 18 which is represented in detail in Figure 4, the unit 10 checks whether constant driving conditions are met. If this is the case, the unit increments a time measurement counter. If not all constant driving conditions are met, the unit 10 in a step 20 sets the time measurement counter and the control bit c_b to 0. After the incrementing of the time measurement counter the unit 10 checks in a step 19 whether the time measurement counter has exceeded a stored critical value. Since the decision block 18 will always run in elementary time intervals, the value of the time measurement counter is proportional to the duration τ' over which time all constant driving conditions are met. If the duration τ' is longer than an applicable value τ, the unit 10 sets

the control bit c_b in a step 21 to 1, sets the virtual control signal α_{virt} to the actual value of the control signal α and switches the constant driving mode on, whereby the phase T begins. If the time period τ' is shorter than the value τ then the unit 10 sets the control bit c_b in step 20 to 0. In an output step 22 the unit 10 finally outputs the control bit c_b.

In the decision block 18 the unit 10 checks in a first step 23 whether the control signal α lies in the interval I_α and whether the change speed α' of the real control signal α lies in the corresponding interval $I_{\alpha'}$ (Fig. 3). If this is the case, the unit 10 checks in a second step 24 whether the speed v of the motor vehicle 12 lies in the interval I_v.

If this is the case, the unit 10 checks in a step 25 whether the speed v of the motor vehicle 12 is greater than a minimum speed v_{min} and in a step 26, whether the highway upward grade m is less than a maximum value m_{max}, whether a speed governing function of the motor vehicle 12 is turned off, and whether the drive unit 11 is switched on to a forward travel position. If one of the conditions checked in steps 23 - 26 is not met, the unit 10 sets in step 20 the control bit c_b to 0. If all of the conditions checked in steps 23 - 36 are met, the program jumps to step 19.

In the constant driving mode the unit 10 uses the virtual control signal α_{virt} instead of the real control signal α. If with the turned on constant driving mode $c_b = 1$, in a run through the decision block 18 one of the conditions checked in the steps 23 - 26 is no longer met, the unit 10 in the step 20 sets the control bit c_b and the time measurement counter to 0, then the constant driving mode is switched off and the phase T ends. In connection therewith the unit 10 activates the drive unit 11 again dependent upon the real control signal α so that the control signal selected from the control signal α_{virt}, α in which dependency the unit 10 activates the drive unit 11, upon switching off the constant drive mode, runs discontinuously.

The time course of the real control signal α and of the virtual control signal α_{virt} is shown in Figure 4, in whose dependency the unit 10 activates the drive unit 11, each of which is represented as drawn through lines. At a point in time t_1 in the step 20 the unit 10 sets the control bit c_b and the time measurement counter to 0. Thereafter finally all of the conditions checked in steps 23 - 25 are fulfilled and the unit 10 increments the time measurement counter until the time duration τ', over which all constant driving mode conditions are met, in the time point τ_2 the value τ reached and the unit 10 in the step 21 sets the control bit c_b to 1, the virtual control signal α_{virt} to the value of the real control signal α assigned to even this time point τ_2, and the constant driving mode switched on. The phase T in which the drive unit 11 is decoupled from the real control signal α, begins. At a time point t_3 the real control signal α abandons the interval I_α whereby the condition checked in step 23 is no longer met and the unit 10 in step 20 sets the control bit c_b to 0 and switches off the constant driving mode. At the time point t_3 the selected control signal α, α_{virt} stops, in whose dependency the unit 10 activates the drive unit 11, discontinuously and jumps by a difference δ between the virtual control signal α_{virt} and the real control signal α.